CLAIMS

What is claimed is:

1. A method of broadcasting multi-layered information in a multi-antenna broadcasting system comprising:

identifying at least a first and second layer of information to be transmitted;

encoding the first layer of information for transmission;

encoding the second layer of information for transmission; and

transmitting the first and second layers of the multi-layered information with the multi-antenna broadcasting system.

2. The method of claim 1, wherein the first layer of information is encoded using a first unitary code matrix and the second layer of information is encoded using a second and different unitary code matrix.

3. The method of claim 2, said step of encoding the first layer of information comprising differentially encoding a product of the first layer of information and the first unitary code matrix.

4. The method of claim 3, wherein U_b represents the unitary code matrix and is selected from the set

$$\mathcal{X}_b = \left\{ \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}, \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \right\}$$

such that the product of the first layer of information and the first unitary code matrix is defined by $U_b \in X_b$.

5. The method of claim 4, said step of encoding the second layer of information comprising differentially encoding a product of the second layer of information and the second unitary code matrix.

6. The method of claim 5, wherein U_a represents the unitary code matrix and is selected from the set

$$\mathcal{X}_a = \left\{ \begin{bmatrix} e^{i\pi\lambda} & 0 \\ 0 & e^{i\pi\gamma} \end{bmatrix}, \begin{bmatrix} e^{i\pi\gamma} & 0 \\ 0 & e^{i\pi\lambda} \end{bmatrix}, \begin{bmatrix} e^{-i\pi\lambda} & 0 \\ 0 & e^{-i\pi\gamma} \end{bmatrix}, \begin{bmatrix} e^{-i\pi\gamma} & 0 \\ 0 & e^{-i\pi\lambda} \end{bmatrix} \right\}$$

such that the product of the second layer of information and the second unitary code matrix is defined by $U_a \in X_a$.

7. The method of claim 6, wherein the transmitted signal X at a time t is defined by $X(t) = X(t-1)U_b(t)U_a(t)$.

8. A multi-antenna system for broadcasting multi-layered information comprising:

means for identifying at least a first and second layer of information to be transmitted;

means for encoding the first layer of information for transmission;

means for encoding the second layer of information for transmission; and

means for transmitting the first and second layers of the multi-layered information with the multi-antenna broadcasting system.

9. The system of claim 8, wherein said means for encoding the first layer of information encode the first layer of information using a first unitary code matrix and the means for encoding the second layer of information encoded the second layer of information using a second and different unitary code matrix.

10. The system of claim 9, said means for encoding the first layer of information comprising means for differentially encoding a product of the first layer of information and the first unitary code matrix.

11. The system of claim 10, wherein U_b represents the unitary code matrix and is selected from the set

$$\mathcal{X}_b = \left\{ \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}, \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \right\}$$

such that the product of the first layer of information and the first unitary code matrix is defined by $\boldsymbol{U}_b \in X_b$.

12. The system of claim 11, said means for encoding the second layer of information comprising means for differentially encoding a product of the second layer of information and the second unitary code matrix.

13. The system of claim 12, wherein $\boldsymbol{U}_a$ represents the unitary code matrix and is selected from the set

$$\mathcal{X}_a = \left\{ \begin{bmatrix} e^{i\pi\lambda} & 0 \\ 0 & e^{i\pi\gamma} \end{bmatrix}, \begin{bmatrix} e^{i\pi\gamma} & 0 \\ 0 & e^{i\pi\lambda} \end{bmatrix}, \begin{bmatrix} e^{-i\pi\lambda} & 0 \\ 0 & e^{-i\pi\gamma} \end{bmatrix}, \begin{bmatrix} e^{-i\pi\gamma} & 0 \\ 0 & e^{-i\pi\lambda} \end{bmatrix} \right\}$$

such that the product of the second layer of information and the second unitary code matrix is defined by $\boldsymbol{U}_a \in X_a$.

14. The system of claim 13, wherein the transmitted signal $\boldsymbol{X}$ at a time t is defined by $\boldsymbol{X}(t) = \boldsymbol{X}(t-1)\boldsymbol{U}_b(t)\boldsymbol{U}_a(t)$.

15. A machine readable storage, having stored thereon a computer program having a plurality of code sections executable by a machine for causing the machine to perform the steps of:

identifying at least a first and second layer of information to be transmitted;

encoding the first layer of information for transmission using a first unitary code matrix;

encoding the second layer of information for transmission using a second unitary code matrix; and

transmitting the first and second layers of the multi-layered information with the multi-antenna broadcasting system.

16. The machine readable storage of claim 15, wherein the first layer of information is encoded using a first unitary code matrix and the second layer of information is encoded using a second and different unitary code matrix.

17. The machine readable storage of claim 16, said step of encoding the first layer of information comprising differentially encoding a product of the first layer of information and the first unitary code matrix.

18. The machine readable storage of claim 17, wherein U_b represents the unitary code matrix and is selected from the set

$$\mathcal{X}_b = \left\{ \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}, \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \right\}$$

such that the product of the first layer of information and the first unitary code matrix is defined by $U_b \in X_b$.

19. The machine readable storage of claim 18, said step of encoding the second layer of information comprising differentially encoding a product of the second layer of information and the second unitary code matrix.

20. The machine readable storage of claim 19, wherein U_a represents the unitary code matrix and is selected from the set

$$\mathcal{X}_a = \left\{ \begin{bmatrix} e^{i\pi\lambda} & 0 \\ 0 & e^{i\pi\gamma} \end{bmatrix}, \begin{bmatrix} e^{i\pi\gamma} & 0 \\ 0 & e^{i\pi\lambda} \end{bmatrix}, \begin{bmatrix} e^{-i\pi\lambda} & 0 \\ 0 & e^{-i\pi\gamma} \end{bmatrix}, \begin{bmatrix} e^{-i\pi\gamma} & 0 \\ 0 & e^{-i\pi\lambda} \end{bmatrix} \right\}$$

such that the product of the second layer of information and the second unitary code matrix is defined by $U_a \in X_a$.

21. The machine readable storage of claim 20, wherein the transmitted signal $\boldsymbol{X}$ at a time t is defined by $\boldsymbol{X}(t) = \boldsymbol{X}(t-1)\boldsymbol{U}_b(t)U_a(t)$.

22. A method of processing multi-layered information received from a multi-antenna broadcasting system comprising:

receiving a wireless transmission comprised of multi-layered information, wherein each layer of the information is encoded;

decoding at least a first layer of information from the wireless transmission; and

presenting the decoded information.

23. The method of claim 22, further comprising decoding a second layer of information from the wireless transmission such that the decoded first layer of information and the decoded second layer of information are presented.

24. The method of claim 23, wherein the first layer of information is decoded using a first unitary code matrix and the second layer of information is decoded using a second and different unitary code matrix.

25. The method of claim 24, said step of decoding the first layer of information comprising differentially decoding a product of the first layer of information and the first unitary code matrix.

26. The method of claim 25, wherein $\boldsymbol{U}_b$ represents the unitary code matrix and is selected from the set

$$\mathcal{X}_b = \left\{ \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}, \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \right\}$$

such that the product of the first layer of information and the first unitary code matrix is defined by $\boldsymbol{U}_b \in \mathcal{X}_b$.

27. The method of claim 26, said step of decoding the second layer of information comprising differentially decoding a product of the second layer of information and the second unitary code matrix.

28. The method of claim 27, wherein U_a represents the unitary code matrix and is selected from the set

$$\mathcal{X}_a = \left\{ \begin{bmatrix} e^{i\pi\lambda} & 0 \\ 0 & e^{i\pi\gamma} \end{bmatrix}, \begin{bmatrix} e^{i\pi\gamma} & 0 \\ 0 & e^{i\pi\lambda} \end{bmatrix}, \begin{bmatrix} e^{-i\pi\lambda} & 0 \\ 0 & e^{-i\pi\gamma} \end{bmatrix}, \begin{bmatrix} e^{-i\pi\gamma} & 0 \\ 0 & e^{-i\pi\lambda} \end{bmatrix} \right\}$$

such that the product of the second layer of information and the second unitary code matrix is defined by $U_a \in X_a$.

29. The method of claim 28, wherein the wireless transmission X at a time t is defined by $X(t) = X(t\text{-}1)U_b(t)U_a(t)$.

30. A system for processing multi-layered information received from a multi-antenna broadcasting system comprising:

means for receiving a wireless transmission comprised of multi-layered information, wherein each layer of the information is encoded;

means for decoding at least a first layer of information from the wireless transmission; and

means for presenting the decoded information.

31. The system of claim 30, further comprising means for decoding a second layer of information from the wireless transmission such that the decoded first layer of information and the decoded second layer of information are presented.

32. The system of claim 31, wherein the first layer of information is decoded using a first unitary code matrix and the second layer of information is decoded using a second and different unitary code matrix.

33. The system of claim 32, said means for decoding the first layer of information comprising means for differentially decoding a product of the first layer of information and the first unitary code matrix.

34. The system of claim 33, wherein $\boldsymbol{U}_b$ represents the unitary code matrix and is selected from the set

$$\mathcal{X}_b = \left\{ \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}, \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \right\}$$

such that the product of the first layer of information and the first unitary code matrix is defined by $\boldsymbol{U}_b \in X_b$.

35. The system of claim 34, said means for decoding the second layer of information comprising means for differentially decoding a product of the second layer of information and the second unitary code matrix.

36. The system of claim 35, wherein $\boldsymbol{U}_a$ represents the unitary code matrix and is selected from the set

$$\mathcal{X}_a = \left\{ \begin{bmatrix} e^{i\pi\lambda} & 0 \\ 0 & e^{i\pi\gamma} \end{bmatrix}, \begin{bmatrix} e^{i\pi\gamma} & 0 \\ 0 & e^{i\pi\lambda} \end{bmatrix}, \begin{bmatrix} e^{-i\pi\lambda} & 0 \\ 0 & e^{-i\pi\gamma} \end{bmatrix}, \begin{bmatrix} e^{-i\pi\gamma} & 0 \\ 0 & e^{-i\pi\lambda} \end{bmatrix} \right\}$$

such that the product of the second layer of information and the second unitary code matrix is defined by $\boldsymbol{U}_a \in X_a$.

37. The system of claim 36, wherein the wireless transmission $\boldsymbol{X}$ at a time t is defined by $\boldsymbol{X}(t) = \boldsymbol{X}(t-1)\boldsymbol{U}_b(t)\boldsymbol{U}_a(t)$.

38. A machine readable storage, having stored thereon a computer program having a plurality of code sections executable by a machine for causing the machine to perform the steps of:

receiving a wireless transmission comprised of multi-layered information, wherein each layer of the information is encoded;

decoding at least a first layer of information from the wireless transmission; and

presenting the decoded information.

39. The machine readable storage of claim 38, further comprising decoding a second layer of information from the wireless transmission such that the decoded first layer of information and the decoded second layer of information are presented.

40. The machine readable storage of claim 39, wherein the first layer of information is decoded using a first unitary code matrix and the second layer of information is decoded using a second and different unitary code matrix.

41. The machine readable storage of claim 40, said step of decoding the first layer of information comprising differentially decoding a product of the first layer of information and the first unitary code matrix.

42. The machine readable storage of claim 41, wherein $\boldsymbol{U}_b$ represents the unitary code matrix and is selected from the set

$$\mathcal{X}_b = \left\{ \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}, \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \right\}$$

such that the product of the first layer of information and the first unitary code matrix is defined by $\boldsymbol{U}_b \in \mathcal{X}_b$.

43. The machine readable storage of claim 42, said step of decoding the second layer of information comprising differentially decoding a product of the second layer of information and the second unitary code matrix.

44. The machine readable storage of claim 43, wherein $\boldsymbol{U}_{\mathrm{a}}$ represents the unitary code matrix and is selected from the set

$$\mathcal{X}_a = \left\{ \begin{bmatrix} e^{i\pi\lambda} & 0 \\ 0 & e^{i\pi\gamma} \end{bmatrix}, \begin{bmatrix} e^{i\pi\gamma} & 0 \\ 0 & e^{i\pi\lambda} \end{bmatrix}, \begin{bmatrix} e^{-i\pi\lambda} & 0 \\ 0 & e^{-i\pi\gamma} \end{bmatrix}, \begin{bmatrix} e^{-i\pi\gamma} & 0 \\ 0 & e^{-i\pi\lambda} \end{bmatrix} \right\}.$$

such that the product of the second layer of information and the second unitary code matrix is defined by $\boldsymbol{U}_{\mathrm{a}} \in X_{\mathrm{a}}$.

45. The machine readable storage of claim 44, wherein the wireless transmission $\boldsymbol{X}$ at a time t is defined by $\boldsymbol{X}(t) = \boldsymbol{X}(t-1)\boldsymbol{U}_b(t)U_a(t)$.